"general" thunderstorms are most liable to occur on either the first or second day. Once having been established, these conditions are likely to continue until a definite replacement of low pressure over the interior of Oregon and Washington by high pressure from the Pacific has taken place.

5. While the types identified in this investigation furnish a practically certain indication of thunderstorms on the national forests of Oregon and Washington, they do not furnish positive indications of whether or not the resulting thunderstorm days will be "intermediate" or "general" in character. It is believed, however, that with the more or less general indications furnished by the type maps and the use of additional aids, such as those furnished in Stevens' report (8), upper air data, dew-point data, etc., an attempt might be made to give somewhat more localized and closely-defined forecasts than have been possible heretofore.

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EFFECT OF INSOLATION ON SOUNDING-BALLOON METEOROGRAPH TEMPERATURE ELEMENTS

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[Weather Bureau, Washington, March 1936]

In view of the increasing interest in stratosphere observations, the recent conclusions reached independently by J. C. Ballard [1] and by L. H. G. Dines [2] regarding the effect of insolation on the temperature element of balloon meteorographs, are worthy of attention.

Dines used 155 soundings which he grouped by months and then subclassified according to day and night, and to ascent and descent. Many of the daytime observations were made near 7h., G. M. T., which corresponds to about 7 a. m., local time in England. The night *descents* were taken as the standard.

Ballard considered about 200 soundings which were grouped according to the three times, 7 a. m., noon, and midnight, C. S. T., for ascents only. The midnight *ascent* was taken as the standard for this study. Ballard's 7 a. m. group corresponds fairly well to Dines daytime ascent group.

Both investigations agree on the following points:

(1) The major part of the insolation effect is a result of the solar rays striking the temperature element, either directly or after one or more reflections inside the ventilating tube.

(2) Diurnal variation and change of air mass are eliminated as possible causes of the discrepancy between daytime and nighttime observations.

(3) The effect of insolation is small in the troposphere compared to its effect in the stratosphere.

(4) 10 kilometers is the critical height above which the error due to insolation becomes excessive.

(5) The poor ventilation resulting from the small density of the air at high altitudes is responsible for the pronounced effect of solar radiation in the stratosphere, and accounts for the fact that the insolation effect increases with height.

(6) The heating of the instrument case, the balloon, and the frame holding the meteorograph are minor sources of error.

The remarkable agreement between the results of the two investigations is shown in the following table of values taken from the published mean error curves:

Dines daytime ascents	Height, kilometer	Ballard 7 a. m. ascents
°C.		°C.
1.0	[1] 8	0.5
1.5	[1] 10	1.0
2.0	[1] 12	2.0
3.0	14	3.0
4.0	16	4.0
5.5	18	5.5
6.0	19	6.0

[1] Dines limited his study to the region between 13 and 19 kilometers, but he extrapolated the curve to lower levels.

Two circumstances are especially significant for this agreement: The first is that the Dines meteorograph was used in England, whereas the Fergusson instrument was used by Ballard. The second is that different methods were used to obtain the results.

The one point of difference in the conclusions from the two studies is in respect to the importance of the angular height of the sun on the effect of solar radiation in the stratosphere. Dines states that the altitude of the sun makes little difference, and that he could find no reason to believe that the recorded temperatures at noon are higher than at other daytime hours; whereas Ballard finds a definite increase in the insolation effect, and consequently an increase in recorded temperature, between the 7 a. m. and the noon ascents.

Both investigations indicate that if the temperature element could be adequately shielded from insolation, the major portion of the error in daytime observations would be eliminated.

[1] Some Results of Sounding-Balloon Observations During the Second Polar Year, August 1932 to August 1933, inclusive. Montly Weather Review, February 1934.

[2] The Rates of Ascent and Descent of Free Balloons, and the Effects of Radiation on Records of Temperature in the Upper Air. Meteorological Office Professional Notes No. 67.